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Enabling Tokenization Options on Hyperledger Fabric

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Agenda

- ¹ Tokenization Overview
- 2 Automated Token Chaincode Generation for Fabric
- ³ Oracle Blockchain Tokenization Customer Examples
- 4 Tokenization Demo
- 5 Summary and Q&A

What is Tokenization And Why it Matters for Enterprises?

Tokenizing an asset makes it trackable, increases its utility, supports automation

- Tokens can be self-describing, i.e., they can include the attributes, rights, and obligations pertaining to the asset, as well as the rules that apply to it
- Tokens can leverage blockchain- or DLT-based systems to support multi-party processes built around trusted, tamper-resistant, and tamper-evident data
- Smart contract-based tokens are programmable

Benefits of Asset Tokenization

- Tracking the digital asset or a digital twin of a physical asset across the enterprise, a B2B ecosystem, or B2C
- Control of the operations that digital systems can perform on the asset based on its state, agreed rules, and the actor attempting to make a change
- Transfer of ownership of, or rights to, the asset provably and securely

From a business perspective, tokenization can affect both the <u>bottom line</u>: process efficiencies and other benefits like fraud reduction and the <u>top line</u>: creating an opportunity for complete multi-party process redesign and new business models.

Tokenization Landscape Beyond Crypto

- First Blockchain Bitcoin was all about tokens, and only tokens
 - Plenty of crypto-currency chains, some more legitimate than others
- Ethereum pioneered programmable tokens based on smart contracts:
 - ERC-20 for Fungible Tokens (FT)
 - ERC-721 for Non-Fungible Tokens (NFT)
 - ERC-1155 combined FTs & NFTs
- New emerging networks, e.g., Flow, supporting NFT marketplaces
 - Digital art
 - Collectibles

Enterprise use cases

FT	NFT
 Loyalty programs Royalty tracking Payments, Funds transfer Digital currency, Stablecoins, CBDC 	 Tracking parts, ingredients, products, documents Inventory finance IP monetization, rights mgmt, data marketplaces ESG investments

There's no native token support in Hyperledger Fabric infrastructure

- But tokens have been built at an application chaincode level by customers and partners, e.g., emulating ERC-20 (FT) or ERC-721 (NFT)
- Common building block for some applications

Oracle Approach to Tokenization

Oracle Blockchain Platform based on Hyperledger Fabric

- Tokenization implementation can be provided as application chaincode, similar to ERC-20/ERC-721 implementations on Fabric
- Requires some optimizations in core peer transaction validation logic to scale

Make standardized application chaincode available as a building block

- Use Blockchain App Builder to generate all necessary chaincode from specification
- Leverage sample specification based on IWA's open source <u>Token Taxonomy Framework (TTF</u>) token templates
- Meta-model that defines base token type (e.g. Fungible), properties (e.g. SKU#), and behaviors (e.g. Transferable, Burnable)
- Optimize peer logic when validating tokenization transactions

Initial Oracle implementation released in June provided Fungible Tokens (FTs)

To be followed by Non-Fungible Tokens (NFTs)

TTF Model and Classification





• Token Type: Fungible or Non-Fungible.

- Token Unit: Fractional, Whole or Singleton.
- Value Type: Intrinsic or Reference indicates if the token itself is a value, like a crypto currency, or if it references a value elsewhere, like a property title.
- Representation Type: Common or Unique.
- Supply: Fixed, Capped-Variable, Gated or Infinite.
- Template Type: Single or Hybrid, is an indication of any parent/child relationships or dependencies between tokens.

t - Transferable

*Ability to transfer ownership of the token. Basic fungible behavior when using cash money, but also applies to non-fungible

"t- Non-transferable

 Restriction of preventing a change of ownership from the initial issued owner. A vote token for an election or an airline ticket are examples.

d - Divisible or $\sim d$ – Indivisible/Whole

Decimal places a token can be divided into.

s - Singleton

There can only be a quantity of one, where the token class represents the only instrument. Like a piece of fine

m - Mint-able

*Ability to issue new tokens of the class. Creating a new property deed or adding money to the overall supply.

r - Role Support

Ability to have roles defined within the class to allow or prevent certain actions.

b - Burnable

Ability to remove tokens from the supply. A token representing a barrel of oil that gets burned when it is refined is a good

https://github.com/InterWorkAlliance/TokenTaxonomyFramework

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Oracle Blockchain Platform | Cloud Service Comprehensive, production-ready BaaS for enterprise applications





Oracle Blockchain Platform | Enterprise Edition

For customers who operate in industries and countries with data sovereignty or data residency requirements that prevent them from deploying on Oracle Cloud

Deploy Oracle Blockchain on-premises

- Choice of virtualization platforms: VMware, OLVM, Virtual Box
- Enterprise-grade with HA and Dynamic Scale-up/Scale-out

Create Blockchain network with a few clicks

 Fully pre-assembled with Hyperledger Fabric 1.4, Blockchain Platform Manager, Operations Console, API/REST Proxy, LDAP/OID/OUD/AD integration

Feature parity with Blockchain Cloud

- Same APIs & portability of applications
- Support for hybrid, multi-cloud networks
 - Oracle Cloud, On-Premise, 3rd party Blockchains using Hyperledger Fabric





Blockchain App Builder | Developer Aids Expedite chaincode development, testing and deployment

Two User Interfaces

- Easy to use, intuitive GUI delivered as Visual Studio Code Extension for interactive development
- A lightweight Command Line Interface for power users and CI/CD automation

Dev, Test, and Deployment Lifecycle

- Scaffold a chaincode project using a spec file
- Auto deployment of Hyperledger Fabric network
- Support for all chaincode lifecycle operations, such as package, install, instantiate, and upgrade
- Ability to deploy and test locally with line-by-line debugging when using local environment and VSC
- Deployment and test in remote OBP network (OBP Cloud Service or on-prem OBP Enterprise Edition)

Code Generation from Specification

- Chaincode generation in TypeScript (node.js) and Golang using model/controller and decorator patterns
- Automatic generation of CRUD methods, ability to add custom logic, and re-generate on update





Blockchain App Builder for Oracle Blockchain Platform Automatic Chaincode Generation and Lifecycle Tools for Testing & Deployment





Blockchain App Builder | Sample Token Specification File

- YAML or JSON file that defines the asset types and their behaviors
- Specify new type of asset: token
 - Defines type and behaviors:
 - Divisible
 - Mintable (max quantity)
 - Transferable
 - Burnable
 - Role definition for minting security
 - Custom properties can be added
 - Specify the standard method types to generate
- Define any custom chaincode functions with API signature





Generated Tokenization Framework

Token SDK

- Supports Token Taxonomy Framework standard behaviours like divisible, mintable, transferable, burnable, roles and holdable
- Supports account based system
- Can be readily used in any custom functions

Token Wrapper Functions

- Supports 30+ out-of-the-box wrapper functions for token lifecycle implementation
 Capability to pass organization id and user id as function parameters
- Functions can be customized
- Embedded function-level security

Built-in Security

- Role-based security on token initialization and account creation
- Token roles support: Minter, burner & notary (escrow)
- Auto-identification of the caller in the function





Supported Token Behaviors and SDK Functions



#	Behavior	Property Example	Function (Standard Functions defined by TTF)
1	Divisible	Decimal = 2 (always >0)	GetDecimals()
2	Roles	Minter	 Rolecheck (Account_ID) GetRoleMembers () AddRoleMember (Role_Name, Account_ID) RemoveRoleMember (Role_Name, Account_ID) IsInRole (Role_Name, Account_ID)
3	Mintable		Mint (Quantity)
4	Transferable		Transfer (To, Quantity)
5	Holdable		 Hold (OperationID, To, Notary, Quantity, TimeToExpiration ExecuteHold (OperationID, Quantity) ReleaseHold (OperationID)
6	Burnable		Burn (Quantity)



Token Lifecycle Management and Controller Functions

	Initialize Tokens		Manage A	counts	Add Ro	oles
Administration	 Initialize<name>Tokens</name> Update<name>Token</name> AddAdmin RemoveAdmin GetTokensByName GetTokenById GetTokenDecimals GetAllTokens 	 CreateAccount GetAllAccounts GetUserByAccountID GetAccount GetAccountHistory GetAccountTransacti GetAccountBalance GetAccountOnHoldB GetUserByAccountID 	onHistory alance	 AddRole RemoveRole GetAllAdmins GetAccountsByRole IsInRole 		
	Minting		Transfer	Es	scrow	Burn
Operations	 IssueTokens GetTotalMintedTokens GetNetTokens 	TransfBulkT	ferTokens ransferTokens	 HoldTokens ExecuteHold ReleaseHold GetOnHoldID GetOnHoldDeta GetOnHoldBala 	Tokens Tokens os ailsWithOperationID nceWithOperationID	• BurnTokens



Using Generated Tokenization Methods and APIs in Applications



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Customer & Partner Momentum Tokenization Use Cases

Rewards Programs (Fungible Tokens)	Digital Currency or Twins Representing Other Assets	Non-Fungible Tokens
Loyalty Programs & Coins	Retail & Wholesale Central Bank Digital Currency (CBDC)	NFT Marketplaces – IP Rights, Personalized Media
Agri supply chain sustainability tracking with Rewards for participation	Certified Supply Chain Tracking and Royalty Accruals for Patented Fabrics	Environmental, Social, and Governance (ESG) Auditability and Investing
CNC Factory Machines Data Collection w/Rewards for	Insurance back-office payments accounting	Inventory Financing on Digital Exchanges
Predictive Maintenance	Freight Transportation Management Services	

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Retailer Decathlon Sprints to the Finish Line with Blockchain



"The true value of blockchain lies in creating an exchange where multiple parties (who in principle have not established trust with one other) can perform secure transactions."

Vojko Kercan, Managing Director, Dhimahi



- Decathlon loyalty program in Eastern Europe
- A network that united the world of sports—enthusiasts, clubs, teams, and events—on one platform
- Customers can earn tokens—called "medals" by shopping in any of the Decathlon stores in the region, and seamlessly redeem the rewards at one of the partners on the blockchain network.
- Customers can track all their transactions in real time in a virtual wallet.

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Encouraging Farmers' Participation in Sustainable Ag Project

Registration

- Participant Registration
- GPS coordinate tracking
- Static data updates

Farm to Mill Provenance

- FFB tagging at farm
- Dynamic data capture
- Online and offline capability
- Tracking from farm to Mill and beyond
- Quality data capture
- Anonymous farmer provision

Incentive Program

- Incentive program to encourage digitize
- Digital wallet to distribute funds
- Accrual of digital wallet point for preferred practices
- Farmer/ Agent information system



- Ability to generate reports on Farmer behavior
- Analyze Impact of Incentive programs
- Analyze quality impact of trainings
- Reporting of provenance



Solution Tenents

- Multi channel data capture (online and offline)
- REST based mobile connections enabling ease of integration
- All actors as registered organizations to enable visibility
- End-to-End cloud implementation to enable rapid organic growth

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Rewards program funded by oil mills to encourage reporting

Product Content and Royalties Tracking for Certified Manufacturing Ecosystem

Key Requirements in Certified Manufacturing for Performance Garments

- Validate the integrity of transactions and shipments across the supply chain.
- Enable multi-tier supply chain visibility of inventories and shipments using a distributed ledger for single source of truth.
- Track royalty earned from partner shipments, handle discrepancies with auditable dispute records, and reconcile royalty payments.

Functional Capabilities

- Tokenization of products and their ingredients to allow IP owner and supply chain partners to:
 - Track inventory and shipments of raw materials
 - Track intermediate and final products
 - Calculate the royalties accrued based on shipments
- "Track and Trace" interface enables tracking
 - Inventory of materials and products made and transferred among the partners
 - Timeline and product composition views
 - Shipments, disputes, and payments
- Smart contract calculates IP owner's royalty earned from shipments and accrues it in partner accounts
- On-chain data synchronized to ADW is used in OAC visualizations of txn. history, inventory, shipments, royalties, company relationships, and product composition across the supply chain Copyright © 2021, Oracle and/or its affiliates. All rights reserved. |



Garment Factory Master Batch Fabric Mi Retail Brand

Supply Chain Ecosystem



Yarn

Supermoney's Securus Insurance Back-office Payments & Reconciliation on OBP

Key Issues in Insurance Accounts Reconciliation

- Discrepancies between accounting and settlement systems
- Significant effort and cost of manual reconciliation between insurers and insurance brokers across financial accounts
- Risk of human errors and fraud impacting regulatory compliance, re-insurance accounting and profitability when retrospectively reconciling book values with settlement values

Solution: Tokenization-based insurance back-office system with accounts reconciliation

- Multi-organization, multi-user permissioned-access platform for MGAs, Brokers and Underwriters
- Web interface user portal
 - Data upload by flat file or API integration
 - Bordereaux screen showing all lines of cover live, lapsed, adjusted and cancelled
 - Filtration and sorting by cover metadata
 - Facility to add line(s) of cover to a single payment basket
- Generation of unique reference for bank payments
- Facility to acknowledge receipt of funds
- Real-time updates and reporting
- Partner contracts commission rates, etc.
- Policy documentation issuance

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SECURUS

Central Bank Digital Currency



Fin. Regulator

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- CB maintains the core ledger, sharded for scalability, distributed for resilience and tamperproofing. It is the only entity capable of issuing CBDC.
- CBDC facilitates the separation of the 'value store' function provided by bank deposits from 'transmission' function.
- A new class of regulated entity, Transaction and Custody Institutions (TCIs) will service the public.
 - TCIs maintain and services user accounts
 - They can't lend money
 - They don't pool deposits
 - They can't monetize transactions
 - TCIs can offer value-add overlay services, e.g., programmable money:
 - Conditional payments
 - Time-based payments
 - Exchange to/from fiat currency
- Contextual privacy Trustees/Validators run MPC key escrow services to allow accountable de-anonymization of transactions for AML/CFT, sanctions enforcement, law enforcement investigations

NFT & Coin Use Cases

NFT

3. News media with massive content archives – iconic photos, stories, videos

NFT

FT

1. Live-event streaming and fan community platform.



It enables headline artists and site members (producers and eventsubscribing creatives and fans) to co-create and experience interactive, live-streamed events.



2. Personalized video made up of fan and pro content



Including exclusive blockchain NFT registered video assets that are used to generate revenue for rights holders (concert performers, sports teams and leagues)



NFT

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Demo Example: Airline Loyalty Program



Demo Example : Airline Loyalty Program – Use Case Flow



Hash Time-Locked Atomic Swap Procedure



Cross-Ledger Interoperability Leveraging Quant Networks

OverLedger solution from Quant Networks available for OBP and deployed in Oracle Cloud

 Middleware that enables interop across OBP, Corda, Quorum, Ethereum, Ripple, Bitcoin, Stellar, IOTA, EOS.

Sample scenarios:

- Cross DLT Asset Ownership Swap
 with cancellation and rollbacks
- Dual DLT Logging (e.g., confirming Fabric txn's on public blockchain)
- More complex orchestrations (e.g., PO/Invoice matching on one DLT and issuing payment on a different DLT, with settlement confirmation to the original DLT)





Demo Components (Part I)



Demo Components (Part II)

Let's Go to the Live Demo



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Summary

 Tokenization projects on permissioned blockchains are often hindered by lack of native tokens and complex development requirements or dearth of skilled chaincode developers

Blockchain App Builder helps in three ways:

- Improves developer productivity
- Enables low-code approach to simple applications
- Provides TTF fungible tokens chaincode on Hyperledger Fabric

Oracle makes enterprise blockchain easy and quick with

- Pre-assembled, managed BaaS infrastructure with built-in API gateway, identity management, operations console, etc.
- Rapid development of blockchain applications using Blockchain App Builder
- Built-in Tokenization SDK & APIs adaptable through declarative specifications
- Optimizations in Fabric nodes for tokenization use cases





Tokenization Chaincode Provided on OBP Samples Page

	chain Platf	orm Cloud Console				
mark2132 (Founder)						
Dashboard Network Nodes	Channels	Chaincodes Developer Tools				
Blockchain App Builder	Chainco	de Samples				
Chaincode Development	Use chainco	de samples to help you learn how to impleme	ent and manage the network's chaincodes.		Token Actions	×
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Sumples		Description: Store two integers (A and B) Installed on peers: 0	that represent two parties with account b	palances. Use operations to query the balances a Instantiated on channels: 0	Specify the channel to invoke the chaincode to and provide any required parameter values. After you click Exec chaincode is live and your network can use it to read from and write to the ledger.	tute, your
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	é	Description: Create marbles where each n color.	marble has a color and size attribute. Assi	gn a marble to an owner and enable operations	Set Associat Palance	
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		Marbles with Fine grained ACLs				
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		Download sample here.	ientation in the form of a Golang horary t	nat can be easily reused for other chaincodes as		
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		user accounts, and assigns the minter role. balances, and query account transaction bi	e. The user who has the minter role will iss history.	sue the tokens and any user with a token account	will be able to transfer tokens, burn tokens, query account	
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Additional Resources

Learn More

http://oracle.com/**blockchain** http://developer.oracle.com/**blockchain**

Oracle Blockchain Blog: <u>blogsoracle.com/blockchain</u> App Builder Video: <u>https://www.youtube.com/watch?v=n00AniQC2Vg</u> App Builder Documentation: <u>https://docs.oracle.com/en/cloud/paas/blockchain-</u> <u>cloud/usingoci/using-chaincode-development-tools.html</u>

Videos: Demos & Customer Stories

- Youtube: Oracle blockchain channel
- Otube: https://video.oracle.com/search?q=blockchain%20platform
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Try OBP in Oracle Cloud Free Tier

https://www.oracle.com/blockchain/cloud-platform/

Once OBP Cloud instance has been provisioned, bring up the Console and navigate to <u>Developer Tools</u> tab to download the Blockchain App Builder for Oracle Blockchain Platform

Download OBP Enterprise

https://www.oracle.com/blockchain/blockchainplatform-enterprise-edition/



Thank You!







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